



## **Dynamics of nitrous oxide production pathways analysed by $^{15}\text{N}^{18}\text{O}$ dual isotope labelling – data from a full-scale wastewater treatment plant**

**Jensen, Marlene Mark; Ma, Chun; Lavik, Gaute; Kuypers, Marcel MM; Smets, Barth F.**

*Publication date:*  
2018

*Document Version*  
Version created as part of publication process; publisher's layout; not normally made publicly available

[Link back to DTU Orbit](#)

*Citation (APA):*  
Jensen, M. M., Ma, C., Lavik, G., Kuypers, M. MM., & Smets, B. F. (2018). *Dynamics of nitrous oxide production pathways analysed by  $^{15}\text{N}^{18}\text{O}$  dual isotope labelling – data from a full-scale wastewater treatment plant*. Abstract from 17th International Symposium on Microbial Ecology, Leipzig, Germany.

---

### **General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

## **Dynamics of nitrous oxide production pathways analysed by $^{15}\text{N}/^{18}\text{O}$ dual isotope labelling – data from a full-scale wastewater treatment plant**

Marlene Mark Jensen\*<sup>1</sup>, Chun Ma<sup>2</sup>, Gaute Lavik<sup>3</sup>, Marcel M. M. Kuypers<sup>3</sup>, Barth F. Smets<sup>4</sup>, Bo Thamdrup<sup>2</sup>

<sup>1</sup>*Technical University of Denmark/Department of Environmental Engineering, Denmark,*

<sup>2</sup>*University of Southern Denmark, Denmark,* <sup>3</sup>*Max Planck Institute for Marine Microbiology,*

<sup>4</sup>*Technical University of Denmark, Denmark*

Nitrous oxide production associated with biological nitrogen transformations can contribute substantially to the CO<sub>2</sub> footprint of both man-made and natural systems, but the pathways and regulation of nitrous oxide production are poorly understood. We developed a  $^{15}\text{N}/^{18}\text{O}$  dual isotope labelling technique to distinguish and quantify these pathways in mixed communities. The use of  $^{18}\text{O}$ -O<sub>2</sub> permits differentiation of hydroxylamine oxidation and nitrifier-denitrification driven nitrous oxide production by ammonium oxidizing bacteria. We analyzed nitrous oxide production pathways during biological nitrogen removal at Lynetten wastewater treatment plant, Denmark. Under anoxia, nitrous oxide accumulated due to denitrification, but nitrous oxide accumulation was ~3 and 1.7 times higher at 30 and 100  $\mu\text{M}$  O<sub>2</sub>, respectively. Oxic nitrous oxide production was dominated by nitrifier-denitrification, reaching 73% of the total, with the remainder due to hydroxylamine oxidation. Our results demonstrate three active pathways of nitrous oxide production, each with different environmental controls. The dual  $^{15}\text{N}/^{18}\text{O}$  isotope labelling approach can contribute to the development of strategies to minimize nitrous oxide emissions from man-made and natural systems.